Cross-City Matters: A Multimodal Remote Sensing Benchmark Dataset for Cross-City Semantic Segmentation using High-Resolution Domain Adaptation Networks

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Abstract

Artificial intelligence (AI) approaches nowadays have gained remarkable success in single-modality-dominated remote sensing (RS) applications, especially with an emphasis on individual urban environments (e.g., single cities or regions). Yet these AI models tend to meet the performance bottleneck in the case studies across cities or regions, due to the lack of diverse RS information and cutting-edge solutions with high generalization ability. To this end, we build a new set of multimodal remote sensing benchmark datasets (including hyperspectral, multispectral, SAR) for the study purpose of the cross-city semantic segmentation task (called C2Seg dataset), which consists of two cross-city scenes, i.e., Berlin-Augsburg (in Germany) and Beijing-Wuhan (in China). Beyond the single city, we propose a high-resolution domain adaptation network, HighDAN for short, to promote the AI model's generalization ability from the multi-city environments. HighDAN is capable of retaining the spatially topological structure of the studied urban scene well in a parallel high-to-low resolution fusion fashion but also closing the gap derived from enormous differences of RS image representations between different cities by means of adversarial learning. In addition, the Dice loss is considered in HighDAN to alleviate the class imbalance issue caused by factors across cities. Extensive experiments conducted on the C2Seg dataset show the superiority of our HighDAN in terms of segmentation performance and generalization ability, compared to state-of-the-art competitors. The C2Seg dataset and the semantic segmentation toolbox (involving the proposed HighDAN) will be available publicly at https://github.com/danfenghong.